

## **STRUCTURE OF SPINDLE**

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention:**

The present invention relates to a spindle for use in a mover  
5 and, more particularly, to such a spindle that prevents splashing of  
released lubricating oil over the outside of the mover.

#### **2. Description of the Related Art:**

Following fast development of electronic technology and  
mechanical technology, a variety of compact and high-power  
10 high-tech devices have been developed to improve the life of  
human beings. These high-tech products are the combination of  
semiconductor chips and precision mechanical mechanisms. During  
operation of these high-tech products, much heat energy is  
produced, and these high-tech products may fail if heat energy is  
15 not quickly carried away. Therefore, cooling fans are commonly  
used in these high-tech products to dissipate heat.

FIG. 1 shows the operation of the mover of an electric  
device, for example, a cooling fan. As illustrated, the mover 10  
comprises an oil bearing 14, a spindle 12 mounted in the oil bearing  
20 14, and a fan blade 18 fastened to the top side of the spindle 12.  
The oil bearing 14 is sintered from metal powder to increase oil  
retaining force. The peripheral and bottom sides of the oil bearing  
14 are blocked, preventing leaking of lubricating oil. During

operation of the mover 10, lubricating oil is released from the oil bearing 14 to form an oil film within the inner diameter of the oil bearing 14 and the periphery of the spindle 12. However, because the top side of the oil bearing 14 is not well blocked, released lubricating oil tends to be forced out of the top side of the oil bearing 14 to contaminate the surroundings or to wet the surrounding circuits, causing a short-circuit. When the mover 10 failed, heat cannot be quickly carried out of the electronic apparatus, and the electronic apparatus may be caused to shut down, or may be damaged by heat.

Therefore, it is desirable to provide a spindle that eliminates the aforesaid problem.

## **SUMMARY OF THE INVENTION**

The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide a spindle, which prevents splashing of lubricating oil from the oil bearing. It is another object of the present invention to provide a spindle, which effectively retains lubricating oil released from the oil bearing. To achieve these and other objects of the present invention, the spindle is mounted in an oil bearing inside a mover and adapted to rotate a follower member, having a plurality of oblique guide grooves formed on and arranged around the periphery and adapted to guide lubricating oil released from the oil

bearing toward the bottom side, preventing splashing of released lubricating oil over the outside of the mover.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a schematic drawing showing lubricating oil  
5 splashed out of the gap in the top of a mover according to the prior art.

FIG. 2 is an elevational view of a spindle made according to the present invention.

FIG. 3 illustrates the spindle used in a mover according to  
10 the present invention.

FIG. 4 is an elevational view of an alternate form of the spindle according to the present invention.

FIG. 5 illustrates the alternate form of spindle used in a mover according to the present invention.

## **15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

Referring to FIG. 2, a spindle 22 is shown having a plurality of oblique guide grooves 24 formed on the periphery. The oblique guide grooves 24 are spaced from one another at a gap and arranged around the periphery of the spindle 22.

20 Referring to FIG. 3, the spindle 22 is mounted in the oil bearing 26 of a mover 20 inside an electric apparatus, for example, a fan (not shown). The top end of the spindle 22 is fastened to a fan blade 28. During rotary motion of the spindle 22, the sloping guide

grooves 24 give a downward thrust force to lubricating oil released from the oil bearing 26, preventing splashing of lubricating oil out of the gap in the top side of the mover 20, and smoothening downward flowing of lubricating oil. Therefore, sufficient  
5 lubricating oil is retained to the gap in between the inner diameter of the oil bearing 26 and the periphery of the spindle 22 during rotary motion of the mover 20, preventing overheat of the mover 20.

The sloping direction of the oblique guide grooves 24 on  
10 the periphery of the spindle 22 is determined subject to the designed direction of rotation of the spindle 22. The sloping angle and the number of the oblique guide grooves 24 are determined subject to the designed maximum speed of rotation.

As indicated above, the formation of the oblique guide  
15 grooves on the periphery of the spindle prevents an overflow of lubricating oil during the rotary motion of the mover, and enables an oil film of certain thickness to be easily established between the oil bearing and the spindle to reduce possible friction and to further improve the performance of the mover and prolongs its service life.

20 FIGS. 4 and 5 show an alternate form of the present invention. According to this embodiment, the spindle 22 has two sets of oblique guide grooves 24 respectively formed on the periphery and arranged around the periphery at different elevations.

The oblique guide grooves 24 can be simultaneously formed on the periphery of the spindle 22 during casting of the spindle 22. Alternatively, the oblique guide grooves 24 can be formed on the periphery of the spindle 22 through a secondary processing process.

5           A prototype of structure of spindle has been constructed with the features of FIGS. 2~5. The structure of spindle functions smoothly to provide all of the features discussed earlier.

          Although particular embodiments of the invention have been described in detail for purposes of illustration, various  
10   modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.